The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

Paper No.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte KOZO SHIMIZY, MASAYUKI OCHIAI
and YASUO YAMAGISHI

Appeal No. 2004-0777
Application No. 09/731,726

ON BRIEF

Before KRATZ, TIMM, and JEFFREY T. SMITH, Administrative Patent Judges.
KRATZ, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal from the examiner's final rejection of claims 1-6, 15 and 16, which are all of the claims pending in this application.

BACKGROUND

Appellants' invention relates to a semiconductor including a solder alloy of a specified composition forming bump(s) for bonding semiconductor elements to a substrate. An understanding

of the invention can be derived from a reading of exemplary claim 4, which is reproduced below.

4. A circuit substrate comprising semiconductor elements bonded thereon through bumps made of a solder alloy,

said solder alloy being an Sn-Ag-based alloy having Sn content of 90(wt%) or more and its Ag content within the range of 1.5 (wt%) to 2.8 (wt%), the amount of α rays in Sn being 0.01 (cph/cm^2) or less.

The prior art references of record relied upon by the examiner in rejecting the appealed claims are:

Bult et al. (Bult)	4,690,725	Sep. 01, 1987
Ogashiwa et al. (Ogashiwa)	6,160,224	Dec. 12, 2000
	(Filing Date	May 12, 1998)
Akamatsu et al. (Akamatsu)[1]	09-260427	Mar. 10, 1997
(published Japanese Patent Application)		

Claims 1-6 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ogashiwa in view of Akamatsu. Claims 15 and 16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ogashiwa in view of Akamatsu and Bult.

We refer to the briefs and to the answer for a complete exposition of the opposing viewpoints expressed by appellants and the examiner concerning the issues before us on this appeal.

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[1] All references to Akamatsu in this decision are to the English language translation of the published Japanese application, of record.

OPINION

Having carefully considered each of appellants' arguments set forth in the briefs and the evidence of record, appellants have not persuaded us of reversible error on the part of the examiner. Accordingly, we affirm the examiner's rejections for substantially the reasons set forth by the examiner in the answer. We add the following for emphasis.

Appellants state that the appealed claims stand or fall together (brief, page 4). Consequently, we select claim 1 as the representative claim on which we decide this appeal as to the examiner's first stated ground of rejection.

Ogashiwa teaches joining an electronic component to a substrate with a solder bump made of an alloy including, inter alia, tin and silver in amounts inclusive of the claimed amounts. See, e.g., column 1, line 59 through column 2, line 19 of Ogashiwa. As evidenced by the embodiment 13 solder composition set forth in Table 1 of Ogashiwa, the use of a solder comprising 92 % tin is disclosed, an amount of tin encompassing the greater than 90 weight percent tin recited in representative claim 1.

Akamatsu discloses semiconductor devices including substrate bonded elements using solder bumps made of a tin alloy that also includes silver, the tin being disclosed as being used in amounts

that can be within the claimed tin weight percent range. See Table 1 of Akamatsu. Like appellants, Akamatsu teaches that a soft error rate can be reduced by employing a tin solder with a low alpha decay, such as less than 0.1 cph/cm^2 alpha decay. See Table 1 of Akamatsu.

The examiner has reasonably determined that one of ordinary skill in the art would have been led to employ a tin and silver containing alloy having a composition within the ranges as set forth in representative claim 1 because Ogashiwa reasonably teaches: (1) using an amount of silver (0.1 to 8 weight percent) that overlaps the claimed 1.5 to 2.8 weight percent range, and (2) using an amount of tin that exceeds 90 weight percent of the composition as fairly explained by the examiner in the answer. Based on the combined teachings of Ogashiwa and Akamatsu, the examiner has further determined that Akamatsu would have led one of ordinary skill in the art to employ alloy components such that alpha ray amounts are lower than 0.1 cph/cm^2 including less than 0.01 cph/cm^2 as here claimed, to limit soft errors. Given the result effectiveness of limiting alpha ray emission as taught by Akamatsu, we agree with the examiner that one of ordinary skill in the art would have arrived at solders with alpha ray amounts

lower than the claimed 0.01 cph/cm^2 upon routine experimentation with a reasonable expectation of success in so doing.

Appellants urge that the applied references do not disclose or suggest a solder with the claimed .01 cph/cm^2 or less alpha ray amount together with an amount of silver and tin as claimed being present in the solder. We disagree for reasons as outlined herein and in the answer.

A specific example showing a solder alloy anticipating the solder compositional requirements recited in representative claim 1 is not required for the prior art to render the claimed subject matter unpatentable as obvious to one of ordinary skill in the art at the time of the invention under § 103(a). In this regard, it is well settled that the relevance of a prior art reference to the obviousness conclusion is not confined to preferred or illustrative embodiments. Rather, a prior art reference may be relied upon for all that it would have reasonably conveyed to one having ordinary skill in the art. In re Beattie, 974 F.2d 1309, 1313, 24 USPQ2d 1040, 1043 (Fed. Cir. 1992); In re Young, 927 F.2d 588, 591, 18 USPQ2d 1089, 1091 (Fed. Cir. 1991); Merck & Co., Inc. v. Biocraft Labs., Inc., 874 F.2d 804, 807, 10 USPQ2d 1843, 1846 (Fed. Cir. 1989).

Also, see In re Peterson, 315 F.3d 1325, 1330, 65 USPQ2d 1379, 1382 (Fed. Cir. 2003)("The normal desire of scientists or artisans to improve upon what is generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages."); In re Boesch, 617 F.2d 272, 276, 205 USPQ 215, 219 (CCPA 1980)("[D]iscovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art."); In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)("[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.").

Moreover, appellants' contention that one of ordinary skill in the art would not be motivated to combine the teachings of Ogashiwa and Akamatsu because lead is an optional ingredient in Ogashiwa but contraindicated in Akamatsu is untenable. Certainly, one of ordinary skill in the art would recognize that the option not to include lead as disclosed in Ogashiwa would be exercised to achieve low alpha amounts and lower soft error as taught by Akamatsu. Rather than point out a lack of motivation, appellants' comments highlight the explicit motivation present within the four corners of the applied references that would have

lead one of ordinary skill in the art to avoid lead and achieve a low soft error rate with lower alpha decay, preferably no alpha decay as described in the abstract of Akamatsu.[2]

To the extent that appellants are asserting that the examples furnished in their specification establish unexpected results for the claimed subject matter, we note that the question as to whether unexpected advantages have been demonstrated is a factual question. In re Johnson, 747 F.2d 1456, 1460, 223 USPQ 1260, 1263 (Fed. Cir. 1984). Thus, it is incumbent upon appellants to supply the factual basis to rebut the prima facie case of obviousness established by the examiner. See, *e.g.*, In re Klosak, 455 F.2d 1077, 1080, 173 USPQ 14, 16 (CCPA 1972). Appellants, however, do not provide an adequate explanation regarding any factual showing in the specification, that is referred to in the brief, to support a conclusion of unexpected advantages.

In particular, appellants have not established that the test results presented represent unexpected results based on the

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[2] Appellants acknowledge the overlap in the alpha amounts disclosed in Akamatsu and that recited in representative claim 1. See, e.g., the paragraph bridging pages 5 and 6 of the reply brief. We note that appellants also acknowledge that such low alpha amounts are achieved by known methods. See, e.g., the paragraph bridging pages 12 and 13 of appellants' specification.

declaration/affidavit of a qualified expert but merely assert such by way of attorney argument in the briefs. Moreover, the specification test results are not reasonably commensurate in scope with the here claimed invention. We note that the specification examples and tables relate to solder alloys used in the specific manufacturing steps depicted in drawing figures 4A to 4G as set forth at page 12 of the specification. Representative claim 1 is not limited to the specific electrode layer and flip-chip bonding that is associated with such test results as outlined in the specification description of drawing figures 4A- 4G and as referenced in the examples of the specification as evident by a comparison of representative claim 1 with appellants' specification. Thus, it is apparent that appellants' evidence is considerably more narrow in scope than the representative appealed claim 1. See In re Dill, 604 F.2d 1356, 1361, 202 USPQ 805, 808 (CCPA 1979).

Moreover, appellants simply have not shown that the examples prepared for comparison represent the closest prior art. Hence, we are not satisfied that the evidence of record that is offered demonstrates results that are truly unexpected and commensurate in scope with the claims. Nor have appellants satisfied their burden of explaining how the results reported for those limited

examples presented can be extrapolated therefrom so as to be reasonably guaranteed as attainable through practicing the invention as broadly claimed.

Having reconsidered all of the evidence of record proffered by the examiner and appellants, we have determined that the evidence of obviousness, on balance, outweighs the evidence of nonobviousness. Hence, we conclude that the claimed subject matter as a whole would have been obvious to one of ordinary skill in the art. Accordingly, we affirm the examiner's § 103(a) rejection of claims 1-6.

Concerning the examiner's § 103(a) rejection of claims 15 and 16 further employing the teachings of Bult, we note that appellants have specified that all of the appealed claims stand or fall together and do not argue the additional features set forth in dependent claims 15 or 16 as patentably distinguishing over the applied references. Consequently, we shall also affirm the § 103(a) rejection of claims 15 and 16 on this record.

CONCLUSION

The decision of the examiner to reject claims 1-6 under 35 U.S.C. § 103(a) as being unpatentable over Ogashiwa in view of Akamatsu and to reject claims 15 and 16 under 35 U.S.C. § 103(a)

as being unpatentable over Ogashiwa in view of Akamatsu and Bult is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a).

AFFIRMED

PETER F. KRATZ Administrative Patent Judge	)
CATHERINE TIMM Administrative Patent Judge	) BOARD OF PATENT APPEALS AND INTERFERENCES
JEFFREY T. SMITH Administrative Patent Judge	)

PFK/lp

ARMSTRONG, WESTERMAN, HATTORI,
MCCLELAND & NAUGTHON
SUITE 1000 1725 K STREET, N.W.
WASHINGTON, DC 20006